Online-to-print Lags and Baseline Number of Citations in 5 Science Citation Index Journals Related to Liver Diseases (2013–2014)

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Objectives: To analyze the length of online-to-print lags in 5 science citation index (SCI) journals related to liver diseases and their effect on the number of citations at the date of print publication. **Designs:** All original papers that were published between April 2013 and April 2014 in 5 SCI journals of liver diseases were systematically collected. The length of the online-to-print lag was defined as the difference between the date of print publication and the date of online publication. The number of citations for an article was obtained on its print publication date (baseline number of citations) and every month thereafter. According to the 2012 journal impact factor (JIF), the journals were divided into high-JIF (JIF ≥ 5) and low-JIF (JIF < 5). **Results:** During the collection period, a total of 1039 original articles were published in the 5 journals. The low-JIF journals had significantly longer online-to-print lags than the high-JIF journals (6.23 ± 2.9 months versus 4.3 ± 1.5 months, $P < 0.001$). The low-JIF journals had a significantly larger proportion of original articles with a baseline number of citations ≥ 1 than the high-JIF journals (41.9% versus 32.3%, $P = 0.002$). A longer online-to-print lag was positively associated with a baseline number of citations ≥ 1 in all 5 journals. **Conclusions:** Online-to-print lags are frequently observed in 5 SCI journals related to liver diseases. In contrast to the hypothesis that JIF was positively associated with the length of online-to-print lags, our study demonstrated that the low-JIF journals had significantly longer online-to-print lags than the high-JIF journals. (J CLIN EXP HEPATOL 2015;5:127–133)

Currently, journal rankings are largely dependent upon the journal impact factor (JIF), which reflects the average number of citations per paper in a journal.^{1,2} Accordingly, improving the JIF has been regarded as one of the primary tasks for nearly all journals, especially the freshly launched and low-impact ones. The most effective strategy to increase the JIF of a journal is for it to publish influential papers that can produce a larger number of citations. Additionally, free online availability of scientific literature might substantially increase the impact of a paper.

Because the JIF calculation is based on the number of citations after print publication, recent studies have sug-

gested that the JIF could be further inflated by increasing the time between the date of online publication and print publication.^{3–5} In one study by Heneberg et al,³ 12 journals containing the highest total number of in press articles and/or the highest numbers articles in press published online in 2010 or 2011 and one online-only journal (i.e., PLoS ONE) were analyzed. The author found that the number of citations received in press publication per year was very similar to those received in print publication.³ Similarly, in another study by Tort et al,⁵ 61 neuroscience journals were analyzed. Among them, some journals did not have any publication delays, while the delay was longer than one year in other journals. Importantly, the authors found that the JIF might be influenced by the publication delay.⁵

Based on the above-mentioned results, it appears to be also reasonable that a journal with a higher JIF has a longer lag from the date of online publication to print publication than a journal with a lower JIF in the field of liver diseases. This study aims to analyze the length of online-to-print lags of 5 SCI journals related to liver diseases and to evaluate the lags' effect on the journal rankings and number of citations before and after print publication.

Keywords: impact factor, citation, liver disease, print publication, online publication

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Abbreviations: CI: confidence interval; HR: hazard ratio; JIF: journal impact factor; OR: odds ratio; SCI: science citation index

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METHODS

Selection of Papers

We collected all original articles that were published in print between April 2013 and April 2014 in 5 SCI journals in the field of liver diseases. They included Hepatology,⁶ Journal of Hepatology,⁷ Liver International,⁸ Hepatology International,⁹ and Hepatology Research,¹⁰ which represented the respective societies for the study of liver diseases with different impact factors (Table 1). Notably, all of the 5 SCI journals were published in print during our study period. Review articles, short communications, case re-

ports, comments/editorials, and letters to the editor were not collected.

Data Collection

We obtained the full texts of all of the included studies. Primary data were collected, including the journals, years, volumes, issues, authors, affiliations, countries, funding, and publication histories. The online publication date was collected from the full-text of every article and/or the official websites of every journal. The print publication date was regarded as the date of the issue of the journal the article appeared in. The online-to-print lag was calculated

Table 1 Characteristics of Papers.

Items	Hepatology	Journal of Hepatology	Liver International	Hepatology International	Hepatology Research
Societies	AASLD	EASL	IASL	APASL	JSH
2012 impact factor	12.003	9.858	3.87	2.642	2.072
No. issues released during the period	13	13	11	4	13
No. original articles published during the period	400	264	170	79	126
<i>According to type of studies</i>					
No. basic studies	285 (71%)	128 (49%)	87 (51%)	20 (25%)	44 (35%)
No. clinical studies	115 (29%)	136 (51%)	83 (49%)	59 (75%)	82 (65%)
No. randomized controlled trials	15	14	11	3	6
<i>According to funding</i>					
No. studies with funding	370 (93%)	217 (82%)	105 (62%)	45 (75%)	65 (52%)
No. studies without funding	30 (7%)	47 (18%)	65 (38%)	34 (43%)	61 (48%)
<i>According to number of countries</i>					
No. single-national studies	261 (65%)	179 (68%)	144 (85%)	64 (81%)	118 (94%)
Africa	0	0	3	0	1
America	94	26	26	6	6
Asia	82	39	51	47	111
Europe	80	111	58	9	0
Oceania	5	3	6	2	0
No. multi-national studies	139 (35%)	85 (32%)	26 (15%)	15 (19%)	8 (6%)
Africa*	0	2	0	0	0
America*	58	22	3	3	0
Asia*	18	13	8	10	7
Europe*	58	46	13	2	1
Oceania*	5	2	2	0	0
No. authors per article - Mean $\pm$ SD	10.8 $\pm$ 5.3	11.4 $\pm$ 5.2	9.2 $\pm$ 4.2	8.5 $\pm$ 3.6	10.1 $\pm$ 4.2
<i>According to number of authors</i>					
No. studies with 1–10 authors	212	126	112	65	75
No. studies with 11–20 authors	170	122	56	14	9
No. studies with >20 authors	18	16	2	0	2

Notes: * the continent where the first author was affiliated.

as the difference between the online and the print publication date. The number of citations per paper was obtained by searching Google Scholar on the 1st – 3rd days of every month. The last search was conducted on May 1, 2014.

Classifications and Definitions

According to the JIF released by ISI Thomson Reuters in June 2013, the journals were divided into high-IF ($IF \geq 5$) and low-IF ($IF < 5$) types. According to the countries the authors were affiliated with, the studies were divided into single- and multi-national types. According to the type of studies, the studies were also classified as clinical and basic types. We further identified whether the clinical studies were described as randomized controlled trials.

The baseline number of citations referred to the number of times a paper had been cited when it was first published in print, rather than online publication. According to the baseline number of citations, the studies were divided into two groups: Group 1 had a baseline number of citations = 0; Group 2 had a baseline number of citations ≥ 1 . A “citation” event was characterized as an increase of at least one citation after print publication. Time to citation was defined as the interval between the date of print publication and first occurrence of a “citation” event. If no “citation” event occurred during the follow-up, we also calculated the interval between the date of print publication and the last follow-up.

Data Analysis

Categorical data were expressed as the frequencies and/or median with range and were compared using the Pearson Chi-square test. Continuous data were summarized as the mean $\pm$ standard deviation and/or the median with 95% confidence intervals (CIs) in boxplots and were compared using the independent t-test or one-way ANOVA. A logistic regression analysis was performed to explore the predictors associated with a baseline number of citations ≥ 1 . Odds ratios (ORs) with 95% CIs were calculated. A Kaplan-Meier curve was employed to express a trend toward an increased number of “citation” events over time. A log-rank test was employed to compare the difference between groups. The median time to citation was also calculated. Given the relationship between the number of citations and length of publication, a Cox regression analysis was performed to explore the predictors associated with a shorter time to citation. Hazard ratios (HRs) with 95% CIs were calculated. A two-tailed $P < 0.05$ was considered statistically significant. SPSS software package version 13.0 was employed for all statistical analyses.

RESULTS

Characteristics of Papers in 5 Journals

During the collection period, a total of 1039 original articles were published in 5 journals (Table 1). It appeared that

high-JIF journals published a higher proportion of basic studies, studies receiving funding, and multi-national studies than low-JIF journals. Hepatology published a larger number of studies conducted in American countries. Journal of Hepatology and Liver International published a larger number of studies conducted in European countries. Hepatology International and Hepatology Research published a larger number of studies conducted in Asian countries.

Online-to-print Lags

The length of the online-to-print lags was significantly different across the journals ($P < 0.0001$) (Figure 1). Specifically, Hepatology Research had the longest mean online-to-print lag (7.4 ± 1.5 months), followed by Hepatology International (6.5 ± 5.5 months), Hepatology (4.9 ± 1.5 months), Liver International (4.8 ± 1.8 months), and Journal of Hepatology (3.5 ± 0.5 months). Hepatology International had the widest range of the online-to-print lags (21–821 days), followed by Hepatology Research (45–529 days), Hepatology (78–479 days), Liver International (62–282 days), and Journal of Hepatology (92–150 days). Low-JIF journals had a significantly longer mean online-to-print lag than high-JIF journals (6.23 ± 2.9 months versus 4.3 ± 1.5 months, $P < 0.001$).

Number of Citations at Baseline

The proportion of original articles with a baseline number of citations ≥ 1 was 37% (46/126) in Hepatology Research, 20% (16/79) in Hepatology International, 22% (37/170) in Liver International, 28% (75/264) in Journal of Hepatology,

Figure 1 Length of the online-to-print lags in 5 journals.

Figure 2 Proportions of baseline number of citations ≥ 1 in 5 journals.

and 49% (197/400) in Hepatology (Figure 2). Low-JIF journals had a significantly smaller proportion of original articles with a baseline number of citations ≥ 1 than high-JIF journals (26% [99/375] versus 41% [272/664], $P < 0.001$).

In all journals, the original articles with a baseline number of citations ≥ 1 had a significantly longer online-to-print lag than those with a baseline number of citations = 0

(Figure 3). In a binary logistic regression analysis, the significant predictors associated with a baseline number of citations ≥ 1 included a longer online-to-print lag in all 5 journals, multi-national studies and randomized controlled trials in Hepatology, and a larger number of authors in Journal of Hepatology (Table 2).

Time to Citation During Follow-up

The median time to citation after print publication was 2 months (95%CI: 1.7–2.3) in Hepatology, 3 months (95%CI: 2.7–3.3) in Journal of Hepatology, 5 months (95%CI: 4.2–5.8) in Liver International, and 6 months (95%CI: 4.6–7.4) in Hepatology Research (Figure 4 panel A). The median time to citation could not be estimated in Hepatology International because the citation events did not occur in half of the papers.

In all the journals but Hepatology Research, the original articles with a baseline number of citations ≥ 1 had a significantly shorter time to citation (Figure 4 panels B–F). In a Cox regression analysis, the significant predictors associated with a shorter time to citation included a baseline number of citations ≥ 1 in 4 journals, a longer online-to-print lags in 3 journals, and a larger number of authors in Hepatology (Table 3).

DISCUSSION

Before the 1990s when only the printed journals were available, the course from acceptance to print publication was substantially delayed,^{11–13} thereby potentially

Figure 3 Difference in the length of the online-to-print lags between original papers with a baseline number of citations ≥ 1 and those with a baseline number of citations = 0 in 5 journals.

Table 2 Results of Binary Logistic Regression Analysis of Predictors for a Baseline Number of Citation ≥ 1 in Different Journals.

Variables	Hepatology Research			Hepatology International			Liver International			Journal of Hepatology			Hepatology		
	OR (95%CI)	P		OR (95%CI)	P		OR (95%CI)	P		OR (95%CI)	P		OR (95%CI)	P	
Length of online-to-print lags (continuous data)	1.92 (1.41–2.62)	<0.001		1.12 (1.02–1.23)	0.021		1.66 (1.32–2.08)	<0.001		2.13 (1.23–3.70)	0.007		1.77 (1.47–2.12)	<0.001	
Number of countries (single versus multiple countries)	0.96 (0.22–4.20)	0.952		1.82 (0.37–9.04)	0.464		0.46 (0.18–1.13)	0.09		0.93 (0.53–1.64)	0.803		0.60 (0.40–0.91)	0.016	
Type of studies (clinical versus basic studies)	1.37 (0.63–2.97)	0.424		1.02 (0.29–3.62)	0.974		1.14 (0.55–2.36)	0.728		1.39 (0.81–2.38)	0.234		0.97 (0.63–1.50)	0.888	
Funding (no funding versus funding)	1.11 (0.54–2.28)	0.787		0.37 (0.11–1.26)	0.111		1.31 (0.62–2.74)	0.479		1.23 (0.62–2.43)	0.557		0.89 (0.42–1.89)	0.769	
RCT (non-RCT clinical study versus RCT)	1.30 (0.23–7.57)	0.767		NA	0.999		0.29 (0.08–1.09)	0.066		0.81 (0.26–2.59)	0.728		0.20 (0.05–0.74)	0.016	
Number of authors (continuous data)	1.04 (0.96–1.14)	0.337		1.02 (0.88–1.18)	0.823		0.96 (0.87–1.05)	0.359		1.07 (1.02–1.13)	0.01		1.02 (0.98–1.05)	0.411	

precluding the rapid dissemination of updated knowledge. However, in the era of electronic/printed journals, online access has been gradually recognized to be important.^{14–17} Scientific publishers have taken full advantage of this feature. Once a paper is accepted, it becomes rapidly available online on some journals' websites. Thereafter, the raw materials will be carefully proofread and typeset by the editors, publishers and/or authors. The major benefit of online publication is that the results of studies can be visible for researchers as early as possible. A survey confirmed also that scientists are accustomed to seeking fresh information from the pre-print articles to support their researches and creative activities.¹⁸ Meanwhile, a new term, “online-to-print lags”, has been coined to describe the interval between online and print publications, and these lags provide an additional opportunity for each paper to be cited before its print publication. Indeed, “online-to-print lags” are common phenomena in 5 SCI journals in the field of liver diseases.

On the other hand, a longer online-to-print lag potentially inflates the JIF that is calculated after the date of print publication.^{3–5} Based on such criticism, it has been hypothesized that the journal rankings may also be influenced by the length of online-to-print lags. However, the present study did not confirm the relationship in 5 SCI journals related to liver diseases. Indeed, high-JIF journals had a relatively shorter online-to-print lag than low-JIF journals, which suggests that the online-to print lags did not change the journal rankings. This unexpected finding may be explained by the following facts. First, the high-JIF journals receive a larger number of submissions than the low-JIF journals, and this is especially true for high-quality studies. Thus, high-JIF journals have a larger reserve of articles and carry a heavier burden of publication. Second, the high-JIF journals often publish a larger number of papers per issue than low-JIF journals. Thus, the wait-list time should be reduced. Third, the low-JIF journals can increase the number of citations by prolonging its exposure to readers.

Another important finding of our study was that a longer online-to-print lag could predict a baseline number of citations ≥ 1 in all 5 of the SCI journals. This was easily explained because the length of publication was positively associated with the number of citations. As we looked more closely at the data, low-JIF journals had a relatively higher proportion of original articles with a baseline number of citations ≥ 1 than high-JIF journals. This phenomenon suggests that the baseline number of citations did not influence the journal rankings.

We also found that an increase in “citation” events after print publication developed earlier in journals with a higher JIF than in those with a lower JIF. In addition, if one article had a baseline number of citations ≥ 1 or a longer online-to-print lag, the time to citation might be

Figure 4 Cumulative chance of receiving the first citation after print publication (panel A) and its difference between original papers with a baseline number of citations ≥ 1 and those with a baseline number of citations = 0 (panels B–F) in 5 journals.

shortened. Indeed, a longer online-to-print lag indicates that the findings will be recognized by more researchers, thereby increasing the chance of being cited at the baseline and during follow-up. By contrast, multi-national studies, type of studies, funding, and the number of authors barely influenced the time to citation.

This study had several limitations. First, only papers published in 5 SCI journals related to liver diseases were collected. Thus, the findings might not be generalizable to other specialized journals. Second, according to the instructions for JIF calculation by ISI Thomson Reuters, the maximum follow-up time should be 24 months. However, the length of follow-up was relatively short (1–13 months) in our study. Thus, we could not evaluate the overall JIF. Indeed, it should be acknowledged that we previously planned to follow these papers for 2 years, but the use of Google search was stopped in Mainland China in June 2014. Third, the use of Google Scholar database to calculate the number of citations is suboptimal. However,

the ISI Web of Knowledge is not freely accessed at our institution. Fourth, we did not calculate the total number of citations at the last follow-up but the time to first citation during follow-up. This was primarily because the number of citations was associated with publication date. Indeed, we supposed the first citation after print publication as a time-dependent event. If a paper did not obtain any new citations during follow-up, it would be censored. Generally speaking, the Kaplan–Meier curve analysis was performed to balance the difference in the length of follow-up and the number of citations among issues.

In conclusion, online-to-print lags are frequently observed in 5 SCI journals in the field of liver diseases. However, these lags do not influence the journal rankings. Indeed, low-JIF journals might have a longer online-to-print lag than high-JIF journals. In addition, the length of online-to-print lags might be positively associated with the baseline number of citations, thereby influencing the time to first citation.

Table 3 Results of Cox Regression Analysis of Predictors for a Shorter Time to Citation in Different Journals.

Journals	Hepatology Research		Hepatology International		Liver International		Journal of Hepatology		Hepatology	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Baseline number of citations (0 versus ≥ 1)	0.89 (0.53–1.48)	0.643	0.38 (0.16–0.90)	0.028	0.6 (0.38–0.95)	0.028	0.68 (0.50–0.92)	0.011	0.63 (0.50–0.78)	<0.001
Length of online-to-print lags (continuous data)	0.97 (0.82–1.16)	0.745	1.11 (1.04–1.19)	0.002	1.17 (1.03–1.34)	0.016	0.82 (0.62–1.09)	0.169	1.11 (1.03–1.18)	0.003
Number of countries (single versus multiple countries)	1.03 (0.37–2.84)	0.96	0.66 (0.26–1.66)	0.378	1.99 (1.10–3.64)	0.024	0.97 (0.71–1.31)	0.824	0.86 (0.69–1.08)	0.191
Type of studies (clinical versus basic studies)	1.02 (0.63–1.66)	0.929	0.70 (0.30–1.63)	0.409	1.08 (0.75–1.56)	0.673	1.39 (1.05–2.84)	0.23	1.08 (0.84–1.37)	0.56
Funding (no funding versus funding)	0.99 (0.62–1.58)	0.962	0.44 (0.18–1.05)	0.064	1.28 (0.89–1.86)	0.186	1.17 (0.82–1.66)	0.39	0.79 (0.51–1.20)	0.266
RCT (non-RCT clinical study versus RCT)	1.24 (0.38–4.04)	0.772	21.63 (0.001–494135.2)	0.548	0.69 (0.34–1.40)	0.303	0.82 (0.41–1.63)	0.571	0.74 (0.41–1.33)	0.309
Number of authors (continuous data)	1.01 (0.95–1.07)	0.725	0.91 (0.80–1.04)	0.151	1.04 (0.99–1.08)	0.121	1.01 (0.99–1.04)	0.34	1.02 (1.00–1.04)	0.022

CONFLICTS OF INTEREST

All authors have none to declare.

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